How to rectify scanned air photos using ERDAS Imagine AutoSync (in the real world)

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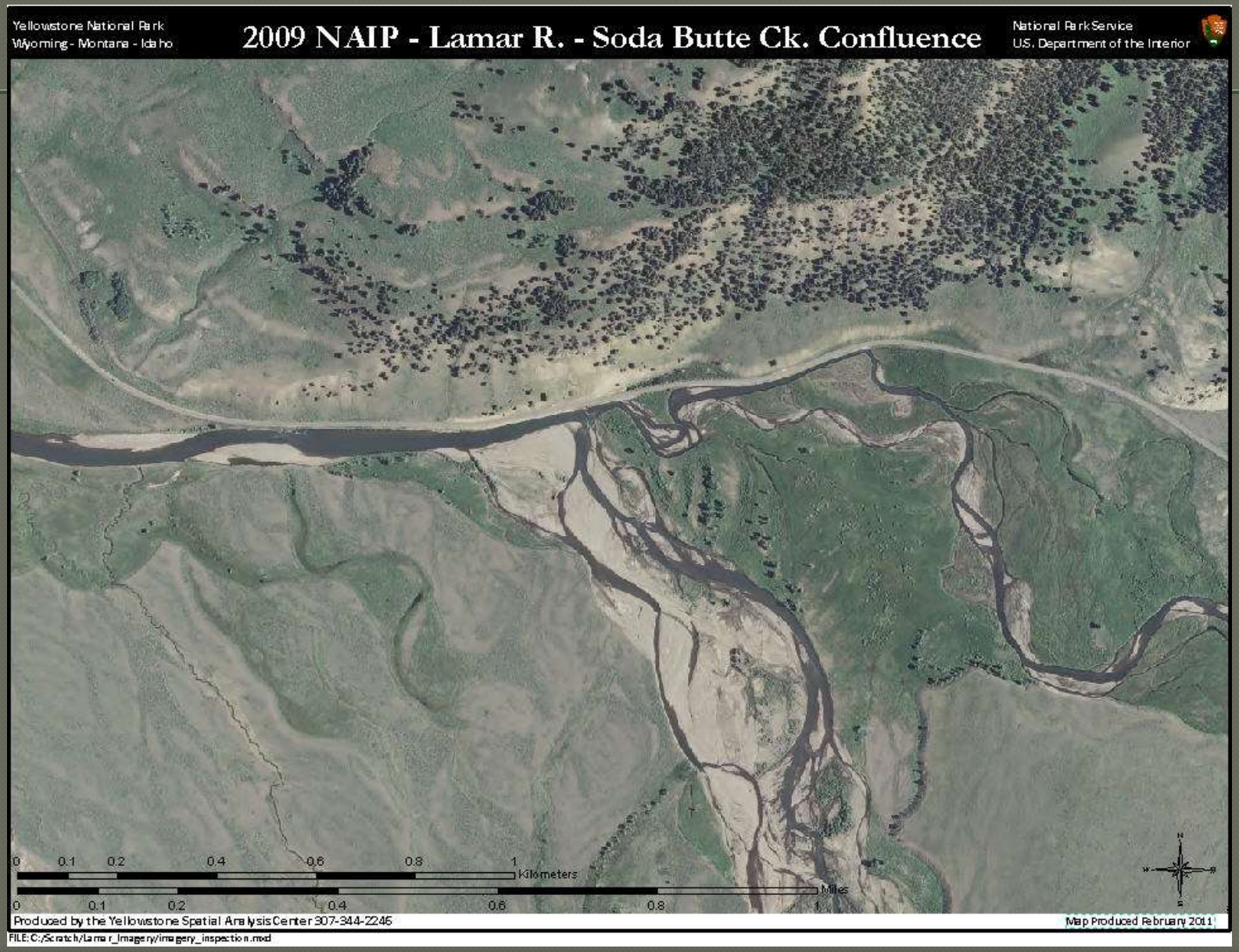
Problem: road is being attacked by streams

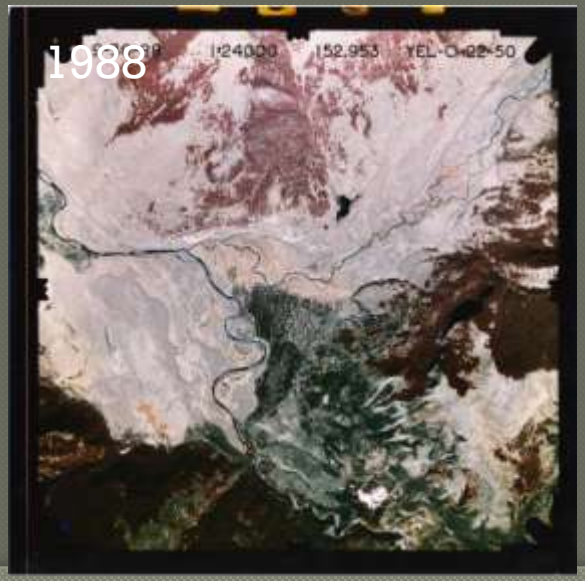


Problem: road is being attacked by streams

What imagery do we have?

- 2009 NAIP
- 2006 NAIP
- 2006 QuickBird
- 2002 CIR DOQQ
- 1996 Grayscale DOQQ
- And…

…a lot of paper photos



So here's the plan:

- Scan air photos
- **Rectify them ←**
- Extract stream courses
- See how the stream changed over time

Options for rectification?

- No camera reports for most
- Multiple scales
- Not a lot of time
- Have an AutoSync license, why not use it?

AutoSync looks so easy

- But it really isn't
- This process, like so much of image processing is a bit of science and a lot of art.
- The ERDAS documentation for this module will help you understand the process - I would suggest scanning over the following - C:\ERDAS\ERDAS Desktop 2010\help\hardcopy\ AutoSync.pdf

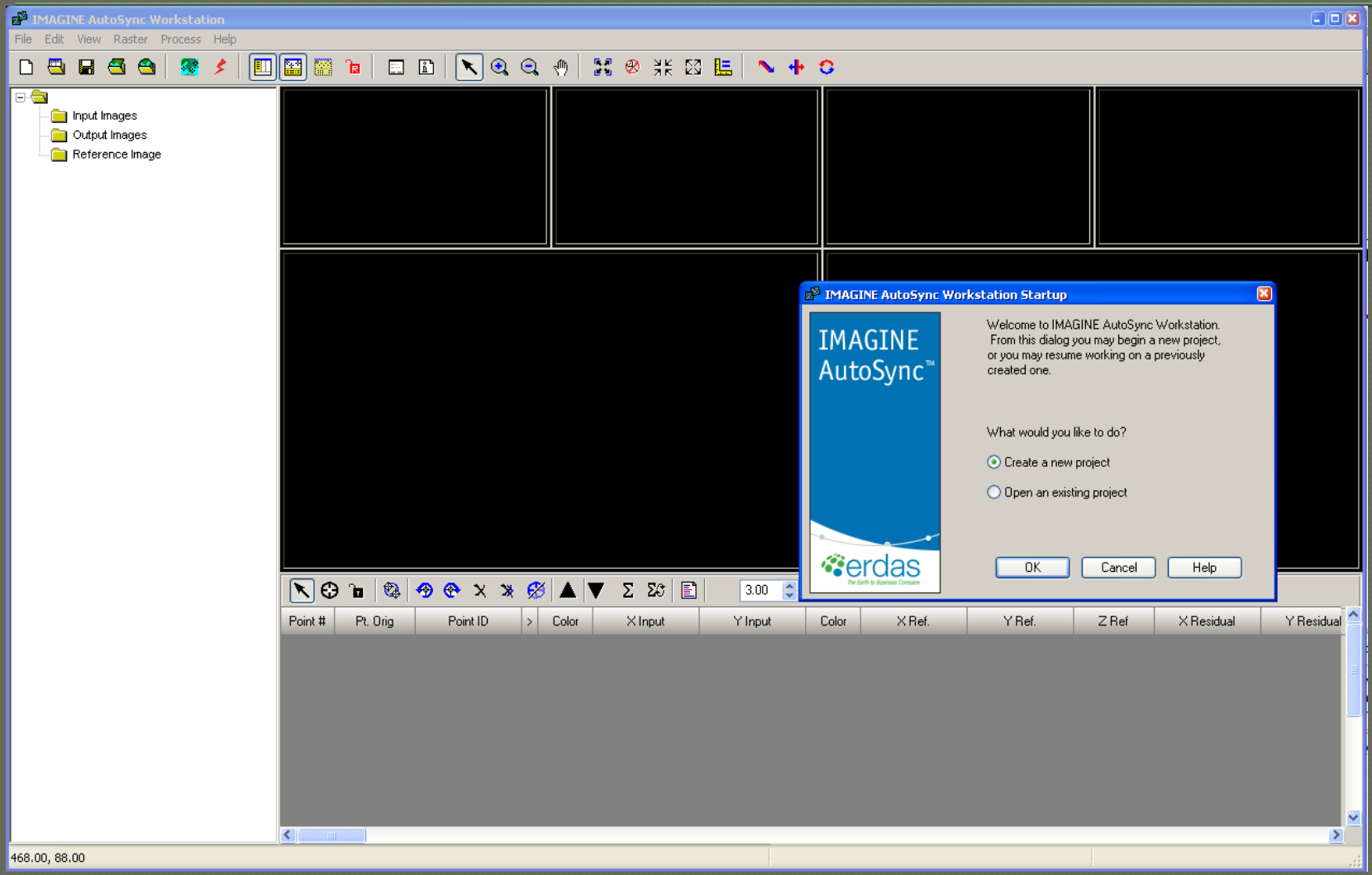
General Process Steps:

1. Prep your reference image (if needed)
2. Create an AutoSync project
3. Add your input and reference images
4. Add manual control points
5. Verify and/or adjust your project parameters
6. Solve model
7. Run automatic point matching (APM)
8. Verify and/or delete control points
9. Re-solve model
10. Export Image

1. Prep your reference image

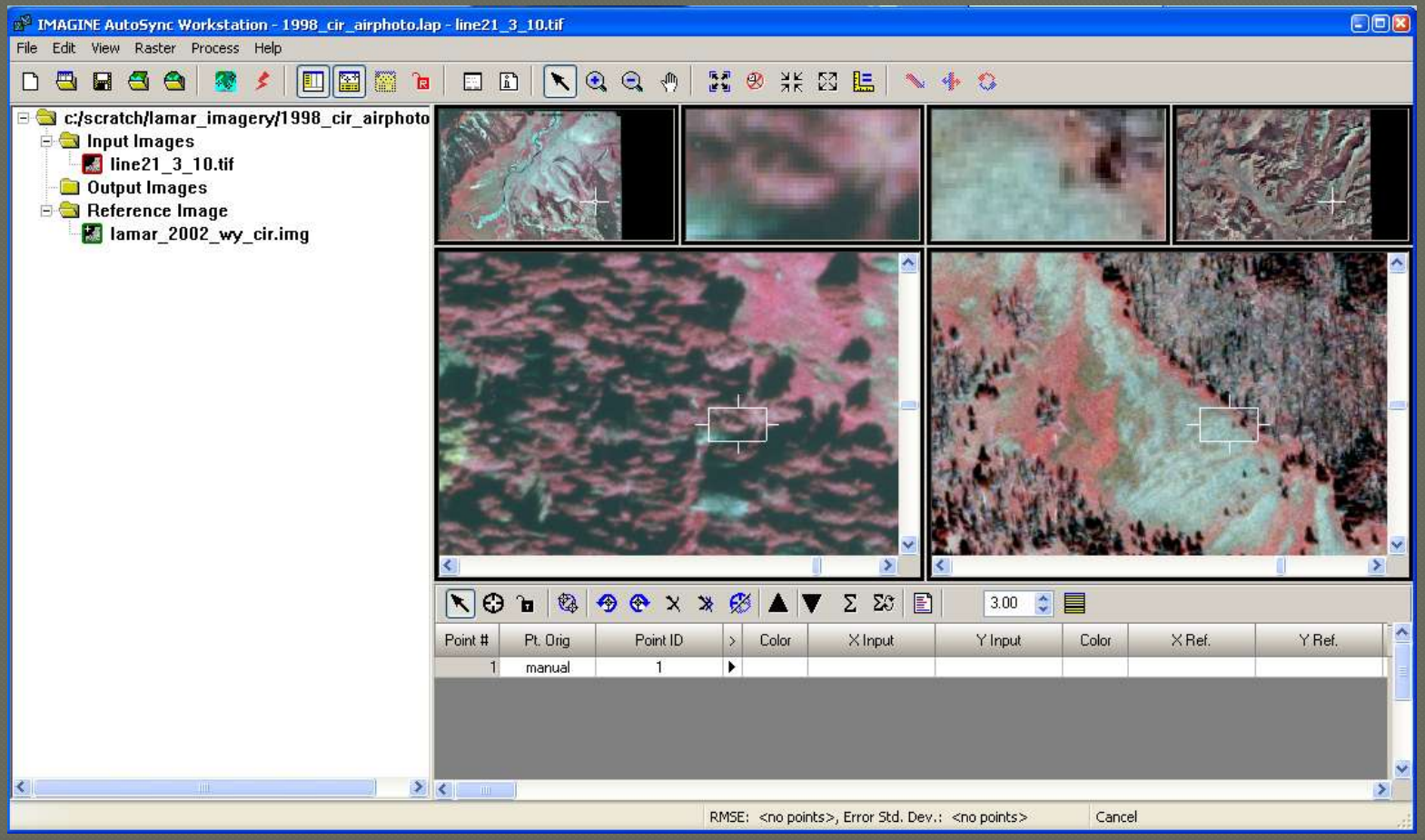
- You must choose your image wisely
- Ideally this image will be larger than the airphoto(s) you are trying to correct and have similar characteristics.
- For instance, if you are attempting to rectify a color infrared air photo of the Seattle area from 1982, you should find a color infrared reference image (or an image with similar bands) that covers the entire Seattle area. Ideally the spectral signature would be similar - if it's a wet year /month you are trying to rectify, pick a reference image taken in a wet year/month.
- You may need to clip out a section of your reference imagery, or mosaic quarter quads together to cover your area of interest. You only get one reference image per project!

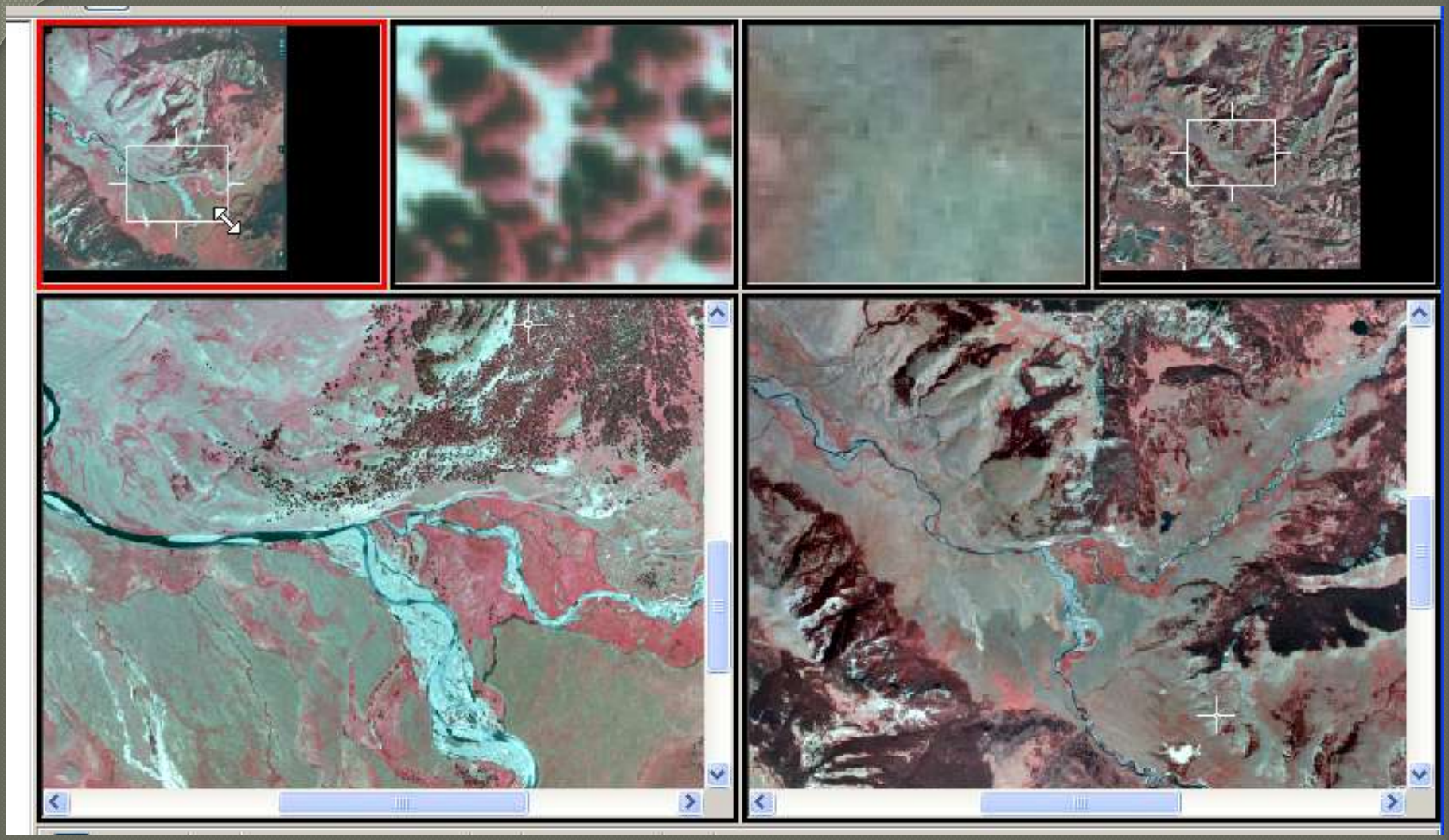
2. Create an AutoSync project



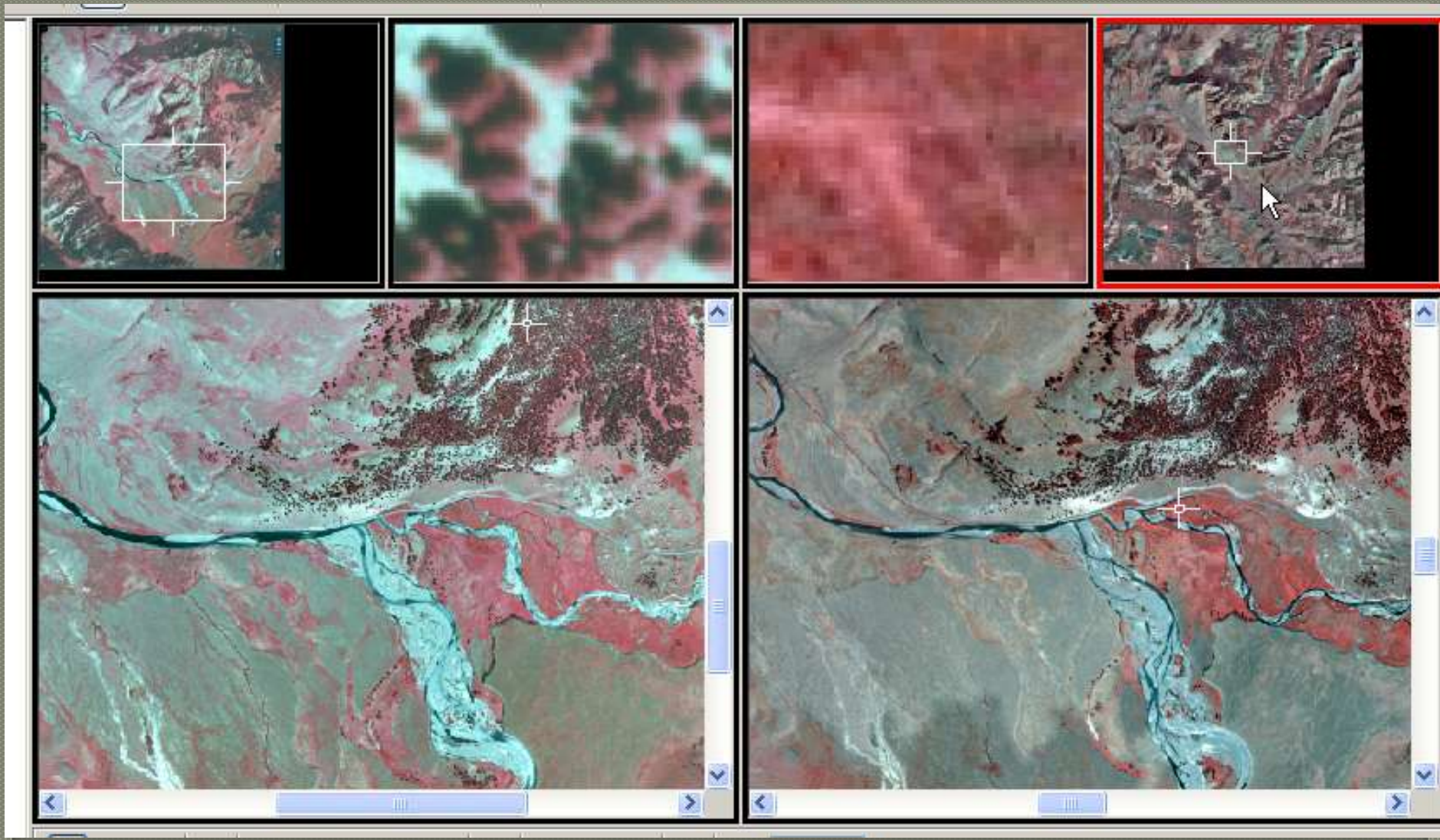
3. Add your input and reference images

- Your input image is the one you want to rectify, the reference image is the one you want to use as your reference.





- In the image above, the upper outside panes have roughly the same size boxes, but different coverage. I will make the right box smaller to compensate:

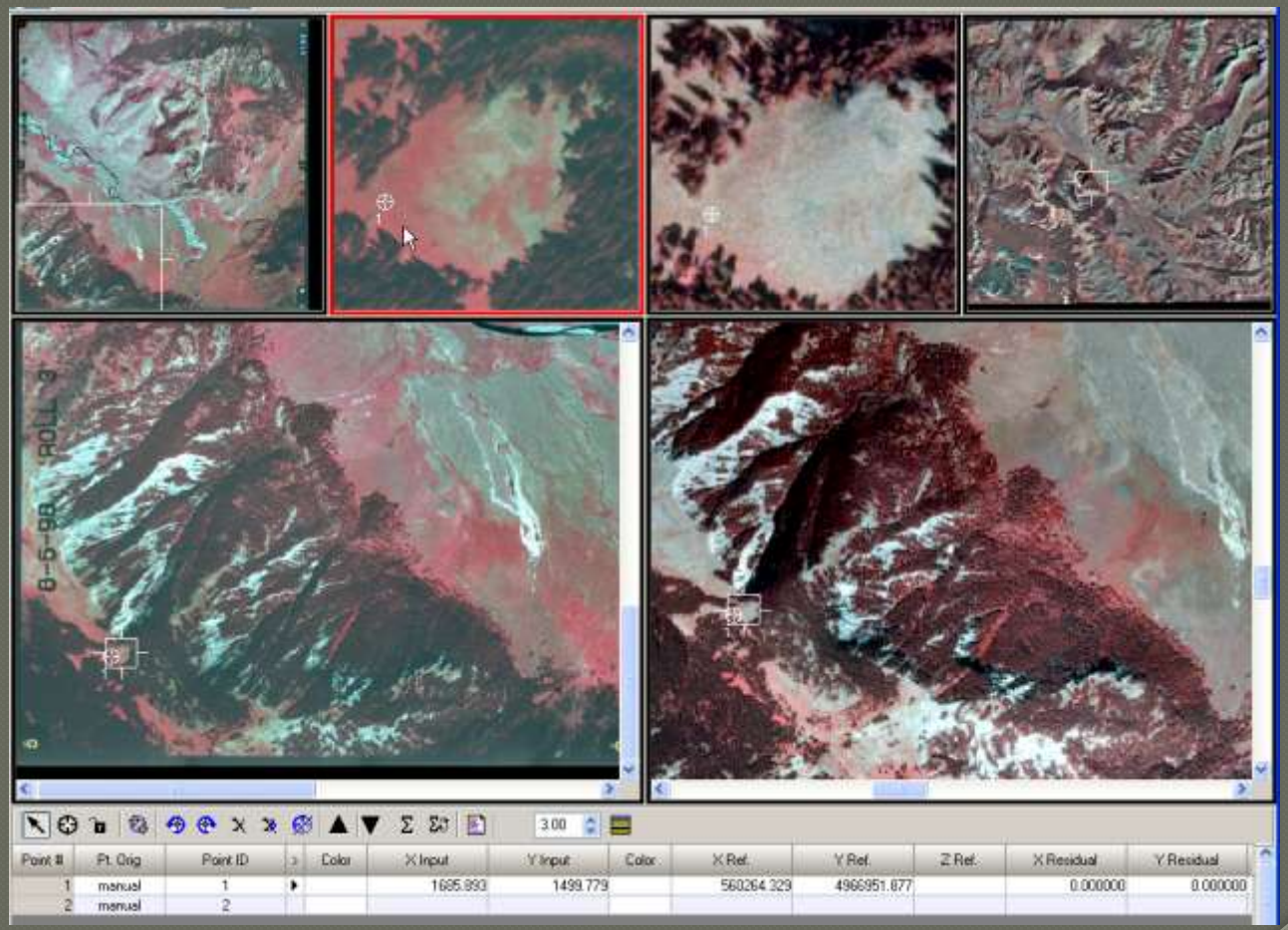


- Just about perfect!
- Now you can adjust the link boxes in the lower panes to about the same size, and use them to zoom in on the image:(look at the inside images on the top) Now we can collect some manual control points to tie the imagery.

4. Add manual control points

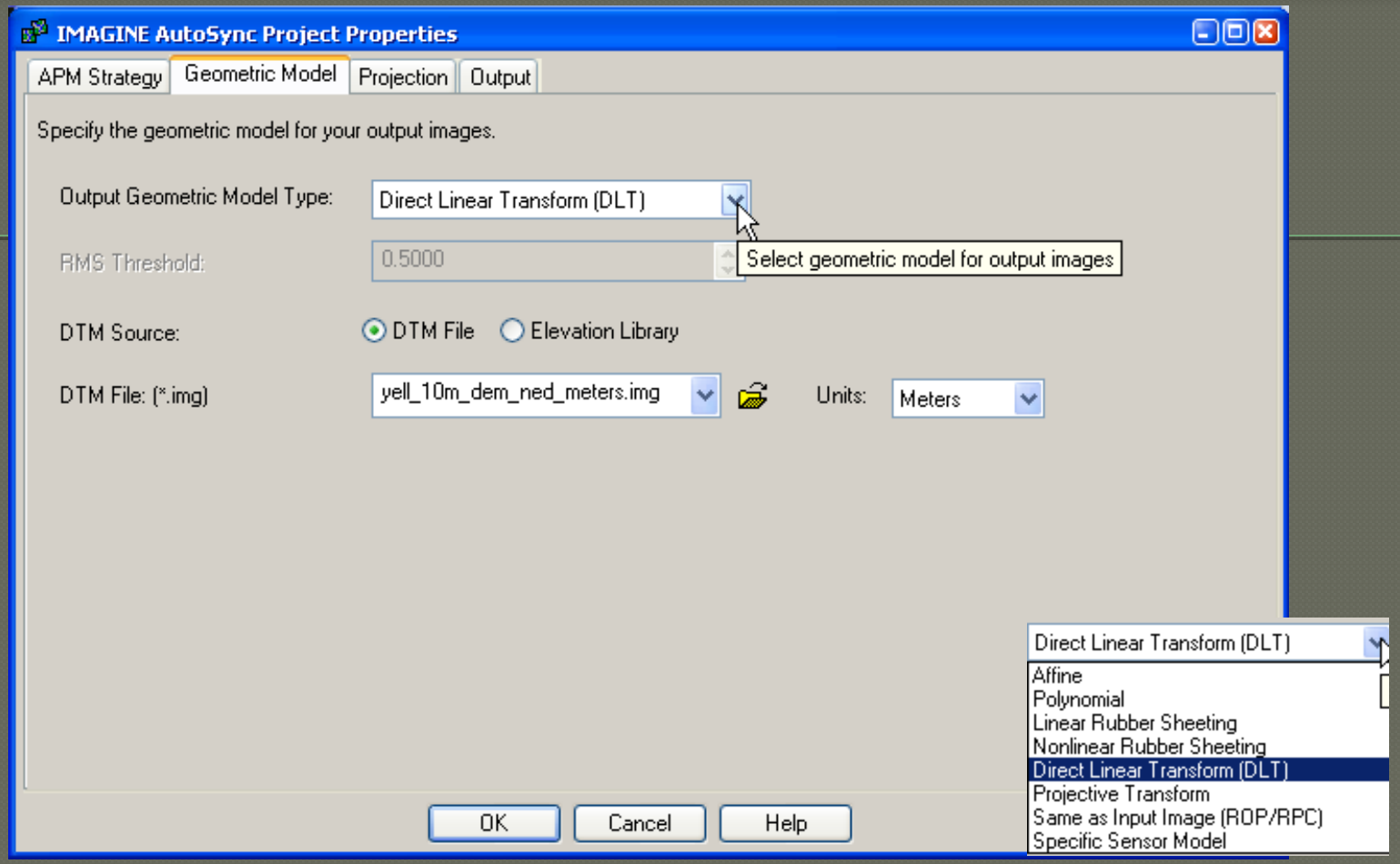
- The text box and tools at the bottom of the window is where you do your control point manipulation.

- Make sure you have a wide distribution of points, and a bare minimum of 10 points total (20 is better).
- For the Lamar project, we chose 9 points (if you divided the image into quarters, the corners would be where we tried to put control points) then we added 11 in our area of interest.

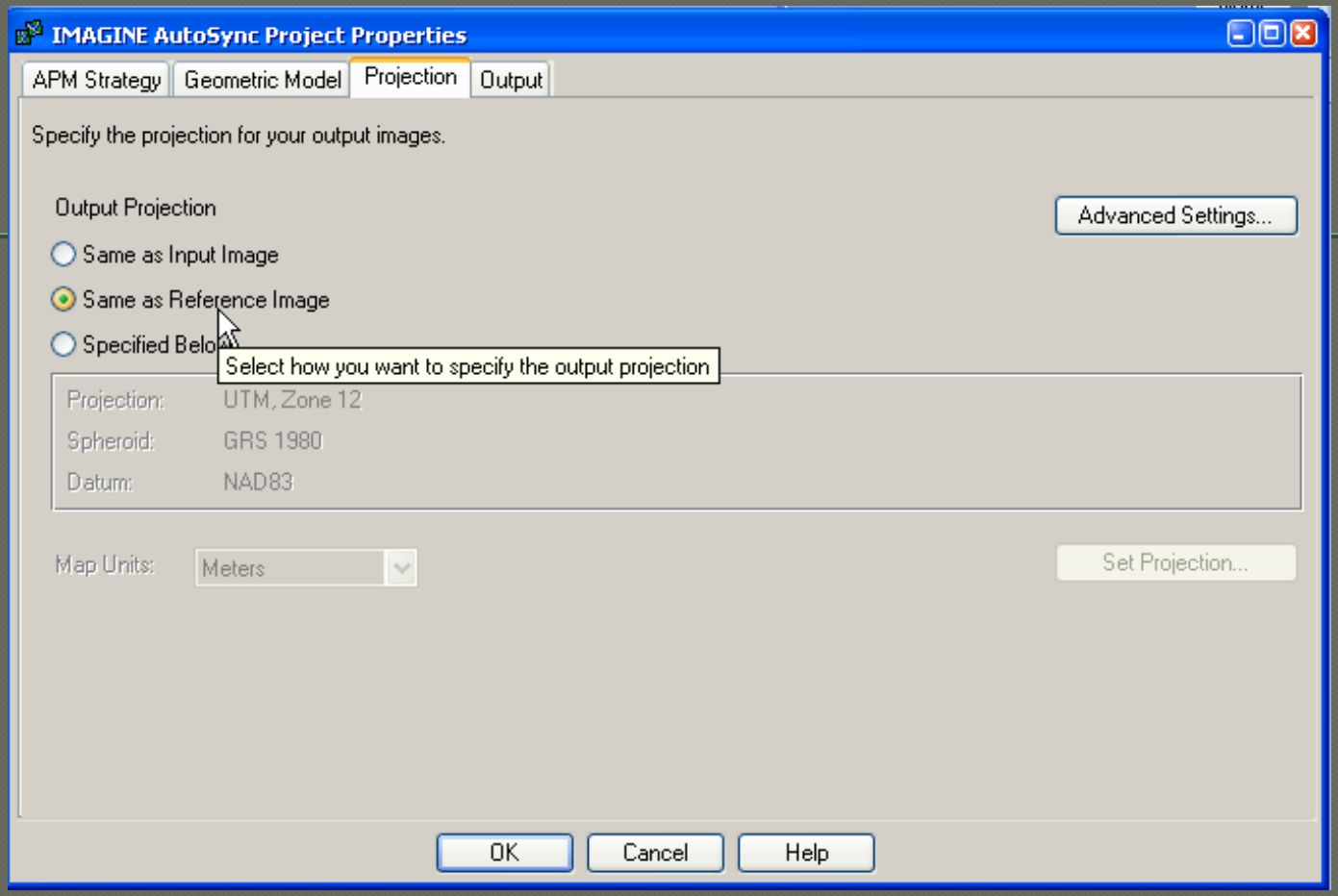


5. Verify and/or adjust your project parameters

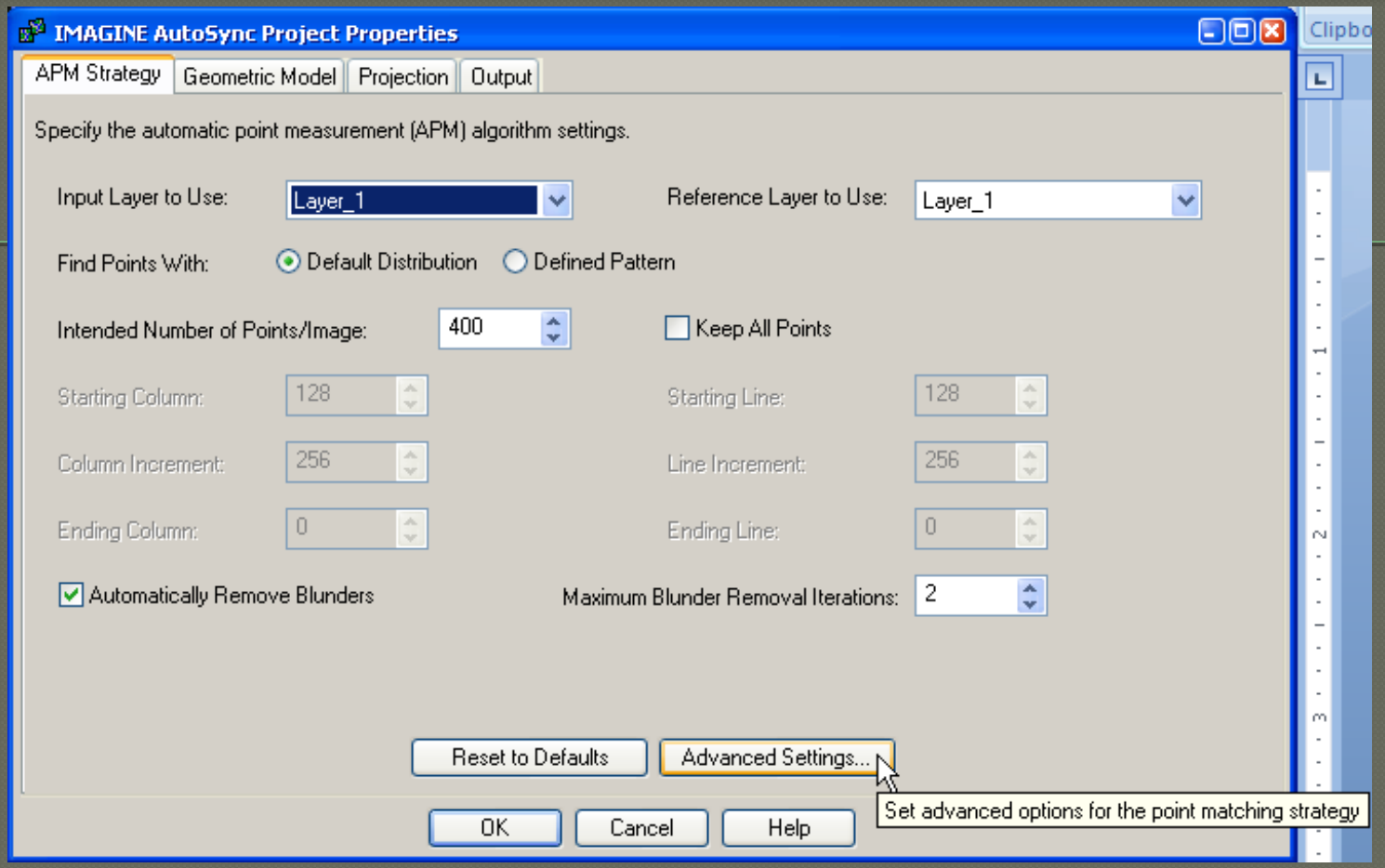
- Before solving your model or running automatic point matching (APM), you will need to set up your parameters
- Here you will define what strategy you want to use for APM, the geometric correction model, projection, and output settings.



- You can read more about modeling in that chapter in the AutoSync manual. For air photos the Direct Linear Transform is typically the best model to use.

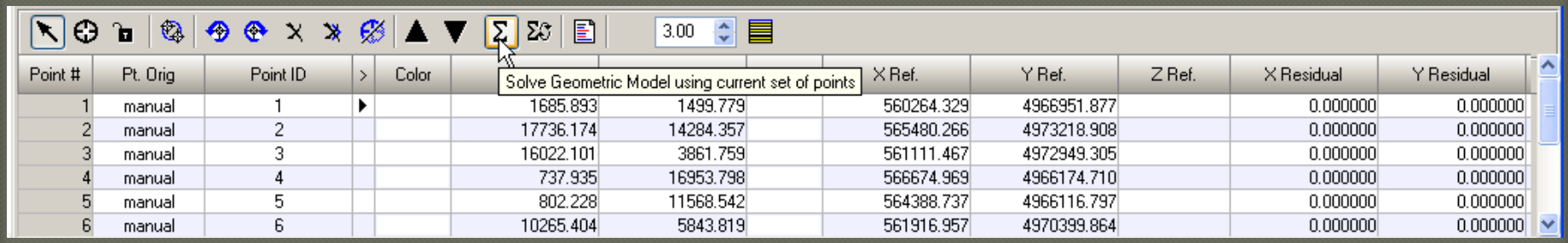


- Make sure the radio button for "Same as Reference Image" is selected
- On the "Output" tab, you can make changes to your output and resampling settings - these were defined when you created your project, so only change the settings if you need to.



- Last, click back on the first tab, the "APM Strategy" tab.
- This tab has a lot of settings, all affecting the generation of automated tie points. You should read the section in the pdf manual "APM Engine" if you have questions.
- Make sure you are matching the correct layer to the correct layer - if you have a 3 band image and a 4 band image, pick the bands that are spectrally closest to one another.

6. Solve model



Point #	Pt. Orig	Point ID	>	Color			X Ref.	Y Ref.	Z Ref.	X Residual	Y Residual
1	manual	1	▶		1685.893	1499.779	560264.329	4966951.877		0.000000	0.000000
2	manual	2			17736.174	14284.357	565480.266	4973218.908		0.000000	0.000000
3	manual	3			16022.101	3861.759	561111.467	4972949.305		0.000000	0.000000
4	manual	4			737.935	16953.798	566674.969	4966174.710		0.000000	0.000000
5	manual	5			802.228	11568.542	564388.737	4966116.797		0.000000	0.000000
6	manual	6			10265.404	5843.819	561916.957	4970399.864		0.000000	0.000000

- Click on the solve button - this will generate the residuals and errors based on your manual tie points. If your RMSE is acceptable, go on to the next step. If not, go through your points and add, delete, or modify as needed.

7. Run automatic point matching (APM)

- Let the fun begin!!!

3.00

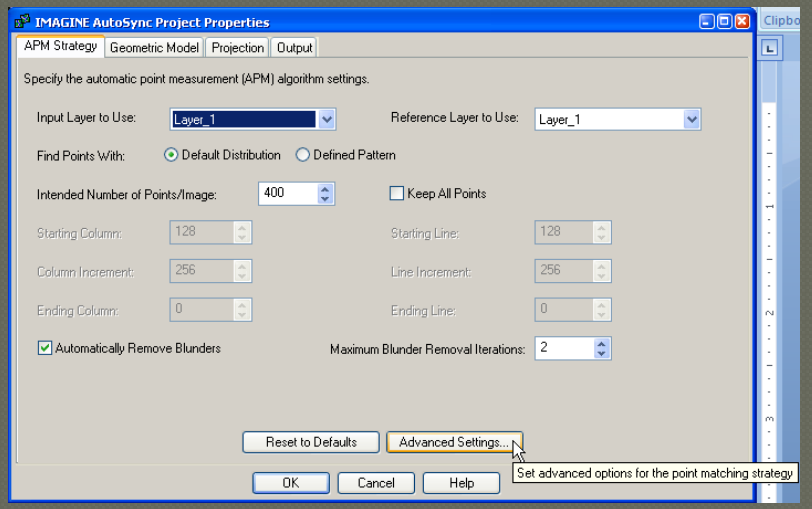
Point #	Pt. Orig	Point ID	>	Color	X Input	Y Input	Color	X Ref.	Y Ref.	Z Ref.	X Residual	Y Residual	Error	Contribution
1	manual	2			214.770	898.037		554687.705	4977480.103	1908.664	3.348767	10.987624	11.486606	0.005294
2	manual	3			7957.915	8899.671		568004.098	4963392.708	2277.592	1.045246	0.009233	1.045287	0.000044
3	manual	4			1675.974	8715.271		557612.828	4964045.473	2736.068	1.781060	-8.214284	8.405155	0.002835
4	manual	5			9862.007	1073.382		571394.779	4976578.549	2569.001	1.296197	-12.256647	12.324996	0.006096
5	manual	6			8888.520	9333.326		569499.298	4962716.543	2412.691	0.870031	-0.524887	1.016101	0.000041
6	manual	7			1872.545	9229.413		557885.019	4963161.162	2659.479	-2.308619	-4.552181	5.104123	0.001045
7	manual	8			1270.001	2939.332		556604.123	4973781.515	2012.665	-2.582546	-2.395382	3.522414	0.000498
8	manual	9			4851.624	5601.440		562822.627	4969028.652	2011.018	2.211216	-2.088820	3.041816	0.000371
9	manual	10			5313.624	5703.858		563614.566	4968838.980	2015.147	-1.882203	-1.320375	2.299147	0.000212
10	manual	11			5858.605	5524.440		564571.543	4969138.267	2064.747	3.799743	-0.610597	3.848490	0.000594
11	manual	12			6320.606	5735.256		565369.640	4968765.083	2035.697	5.623317	-3.021097	6.383472	0.001635
12	manual	13			6557.586	6294.440		565758.835	4967795.789	2045.685	4.503619	-4.264125	6.202044	0.001544
13	manual	14			6310.887	5549.858		565357.324	4969084.075	2056.895	6.399383	-1.067229	6.487764	0.001689
14	manual	15			4588.478	6748.217		562338.596	4967051.884	2028.854	0.910580	-2.920899	3.059544	0.000376
15	manual	16			5800.295	813.981		564574.007	4977125.393	2511.169	-0.294660	3.316453	3.329518	0.000445
16	manual	17			9956.054	5920.654		571232.203	4968425.152	2726.069	-2.894030	-2.952562	4.134372	0.000686
17	manual	18			4518.954	5056.459		562254.845	4969984.397	2020.685	-0.116974	-2.014135	2.017529	0.000163
18	manual	19			3886.507	5676.197		561145.146	4968915.342	2032.467	-0.109901	2.014895	2.017890	0.000163
19	manual	20			4050.226	4573.527		561451.822	4970831.759	2030.641	-0.330335	0.847902	0.909977	0.000033

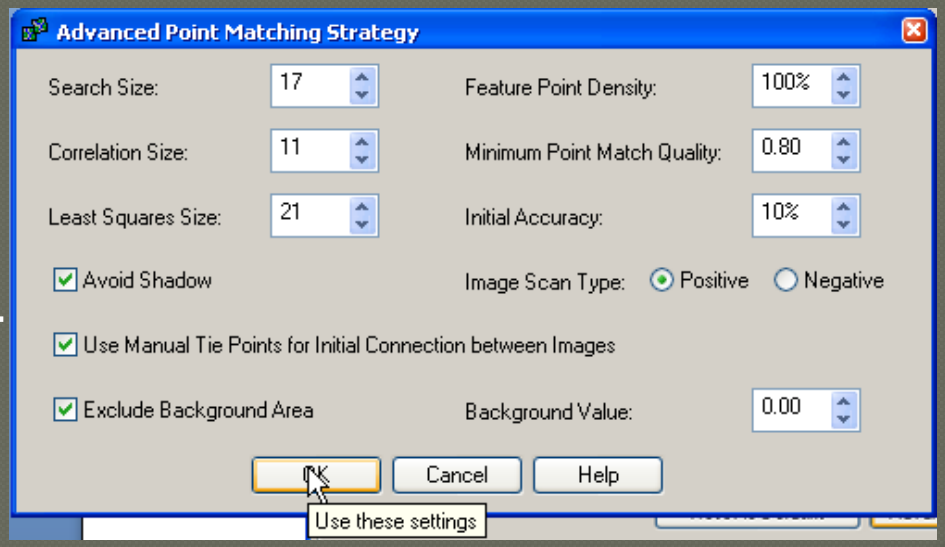
RMSE: 8.06, Error Std. Dev.: 5.394 (input) pixels

Output Projection: UTM

Oh &*@$!! What went wrong?

- You have horrible RMSE and none of your points match up - what do you do?
- Don't panic!
- Delete the auto-generated points
- Check and adjust your settings
- Try a different band
- Worst case: Start a new project with a different reference image



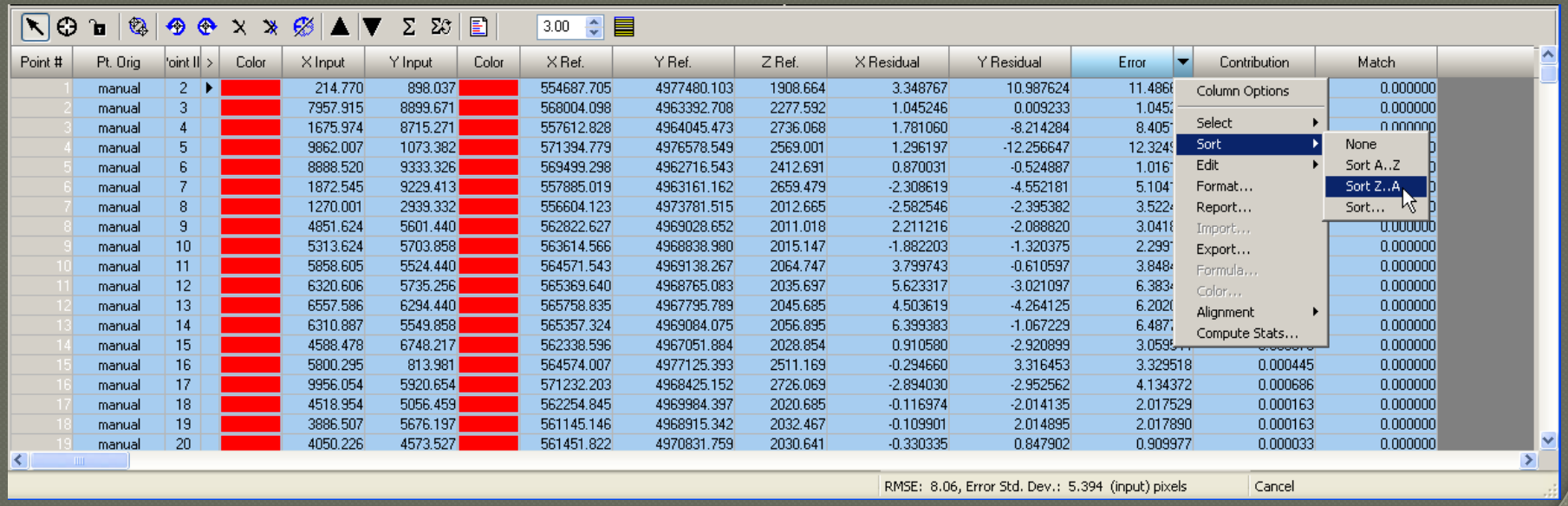


OK, I can live with this RMSE…

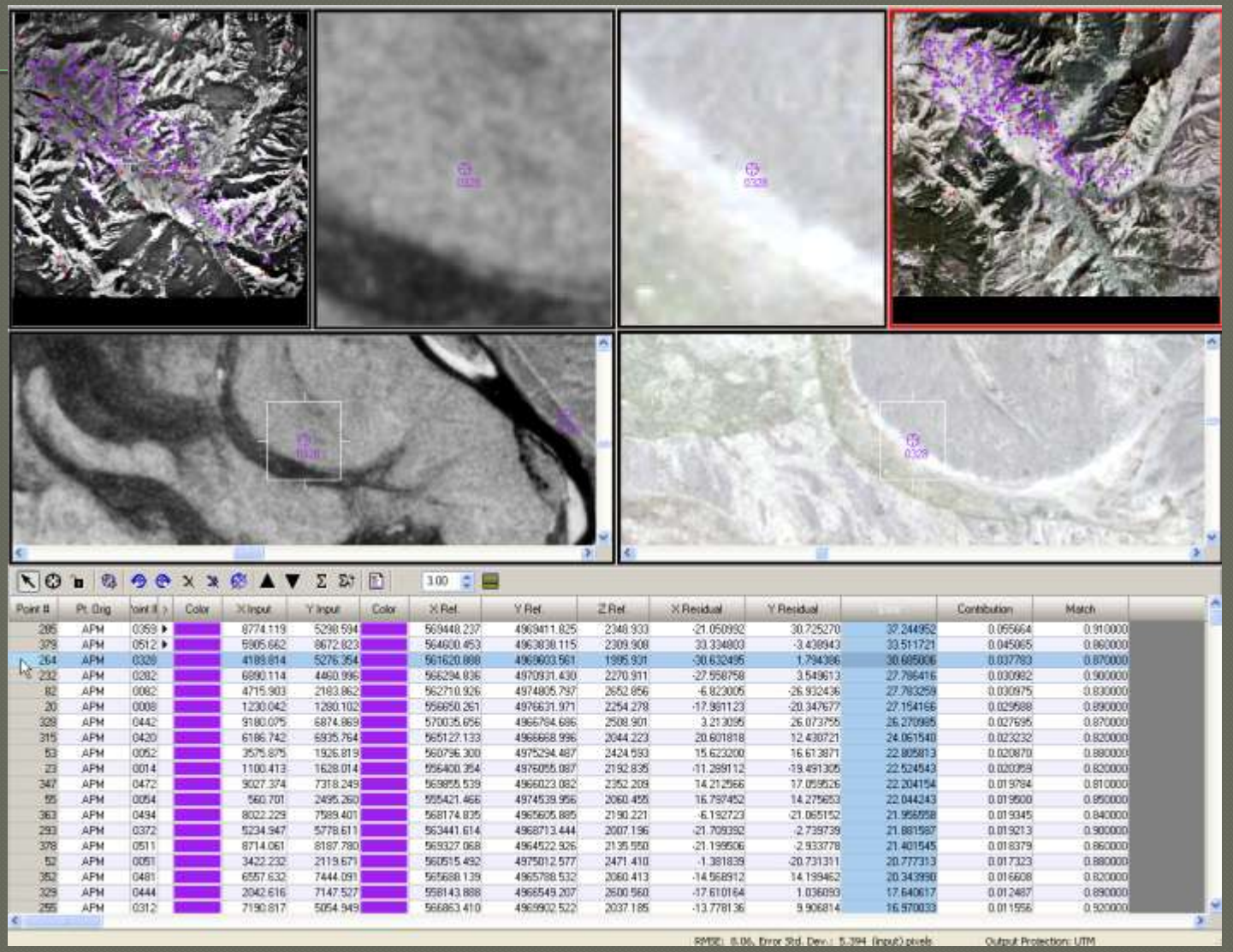
8. Verify and/or delete control points

- There are a couple of ways you can go about checking the control points - deleting those over a certain error threshold or stepping through your points manually. I like a combination of both.

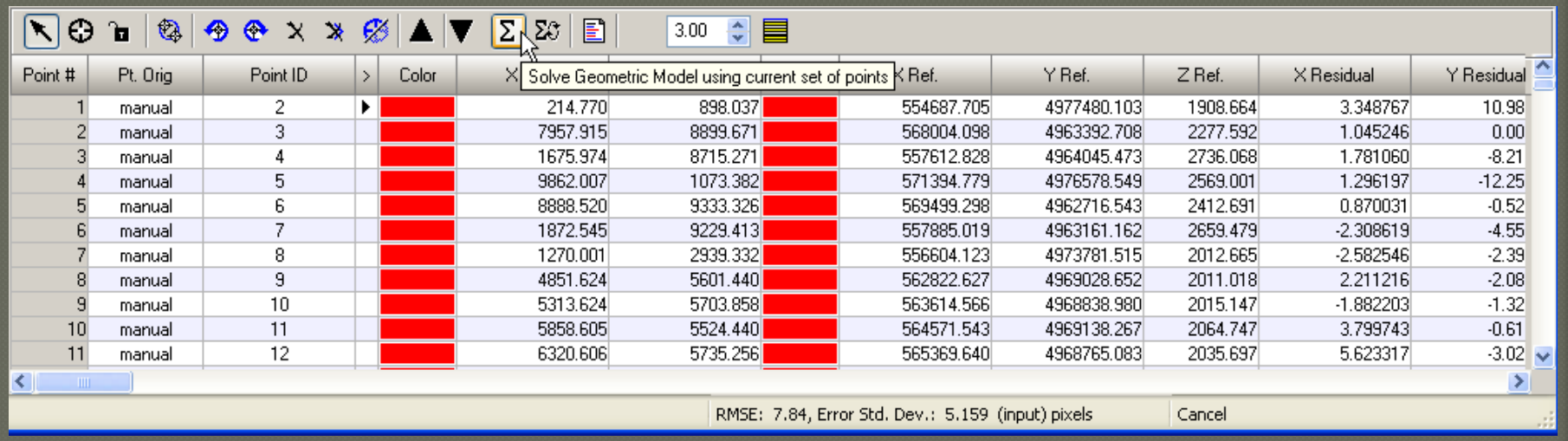
- Sort your points by error, highest first
- Now you can see what kind of error you are talking about - is it just a few outliers, or a bunch of bad matches? Usually this happens because of ground condition changes like fire, phenology, stream changes, landslides, etc.



- In this example, there are some definite errors. I would step through the points until I started getting into "good" points, then delete those points with a greater error. Then re-solve the model.
- Rinse
- Repeat
- Alternately, you could step through each point and visually check it. This depends on your time constraints.



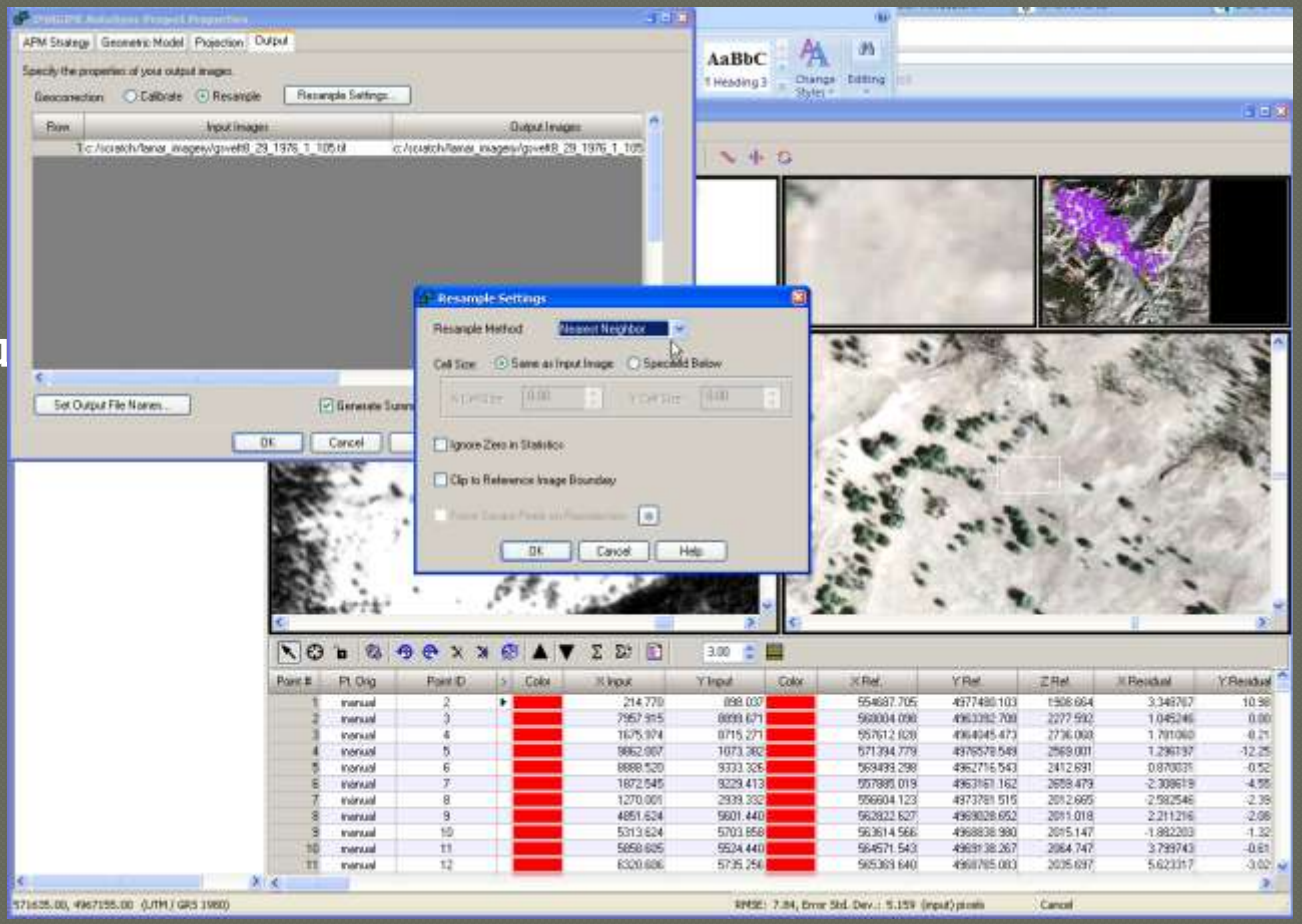
9. Re-solve model



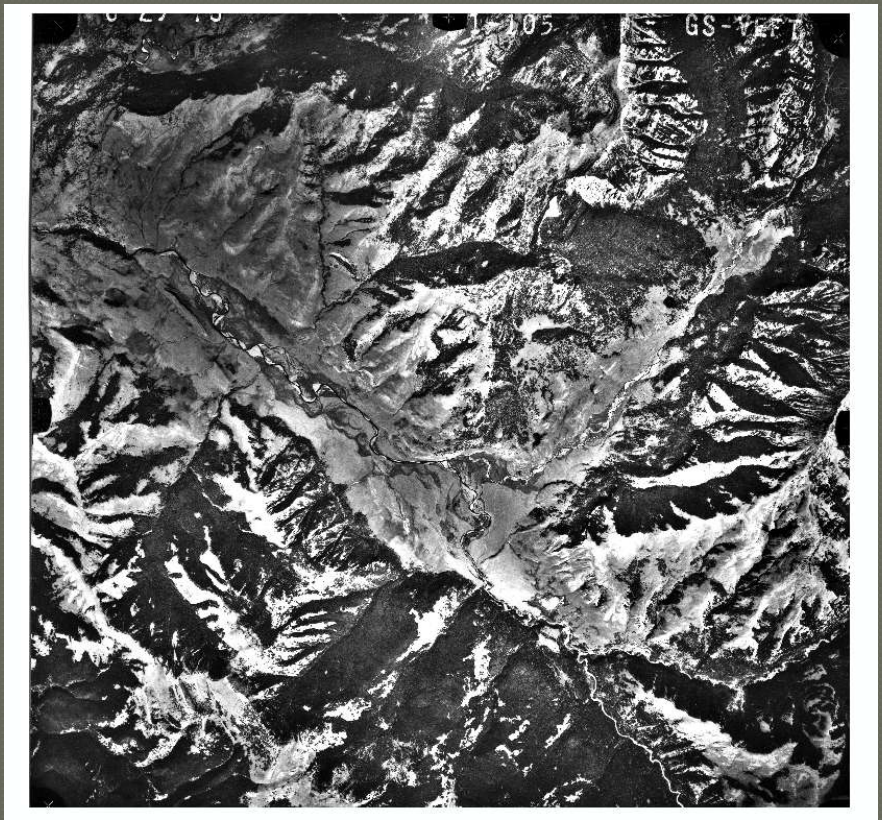
Point #	Pt. Orig	Point ID	>	Color	X	Y	X Ref.	Y Ref.	Z Ref.	X Residual	Y Residual
1	manual	2	▶		214.770	898.037	554687.705	4977480.103	1908.664	3.348767	10.98
2	manual	3			7957.915	8899.671	568004.098	4963392.708	2277.592	1.045246	0.00
3	manual	4			1675.974	8715.271	557612.828	4964045.473	2736.068	1.781060	-8.21
4	manual	5			9862.007	1073.382	571394.779	4976578.549	2569.001	1.296197	-12.25
5	manual	6			8888.520	9333.326	569499.298	4962716.543	2412.691	0.870031	-0.52
6	manual	7			1872.545	9229.413	557885.019	4963161.162	2659.479	-2.308619	-4.55
7	manual	8			1270.001	2939.332	556604.123	4973781.515	2012.665	-2.582546	-2.39
8	manual	9			4851.624	5601.440	562822.627	4969028.652	2011.018	2.211216	-2.08
9	manual	10			5313.624	5703.858	563614.566	4968838.980	2015.147	-1.882203	-1.32
10	manual	11			5858.605	5524.440	564571.543	4969138.267	2064.747	3.799743	-0.61
11	manual	12			6320.606	5735.256	565369.640	4968765.083	2035.697	5.623317	-3.02

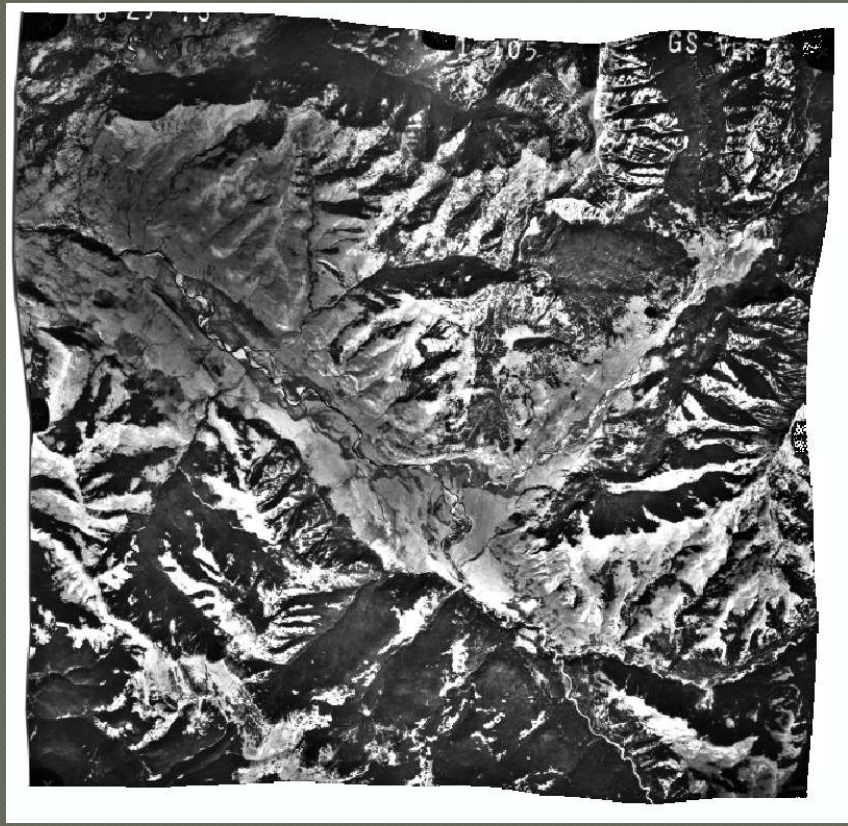
10. Resample Image (create output image)

- It's a good idea to verify your project parameters again - On the "Output" tab, you can make changes to your output and resampling settings - these were defined when you created your project, so only change the settings if you need to.



Presto!





More Magic…

THE EFFECT OF RIP-RAP ALONG SODA BUTTE CREEK NEAR THE CONFLUENCE OFTHE LAMAR RIVER AND AT ROUND PRAIRIE

Figure 1. Photograph of the Lamar River drainage showing grassy river terraces and snow-covered Absaroka Mountains.

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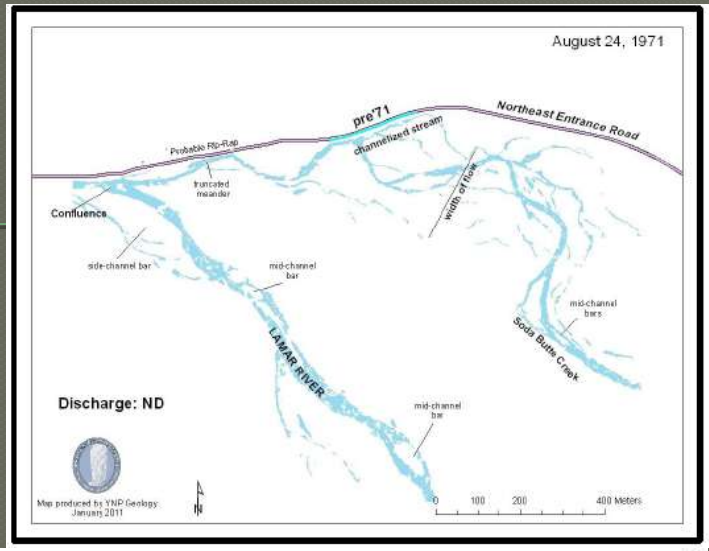
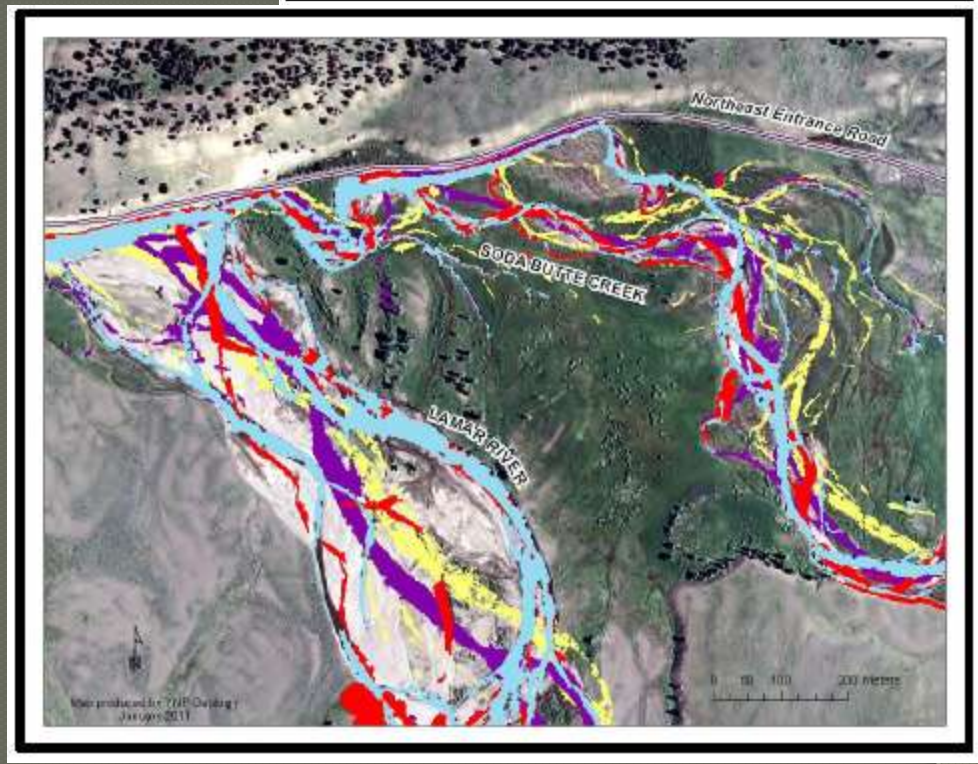
February 22, 2011





Questions?

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